# Homing experiments with an African antelope

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During a study on behavior, social organization, and reproduction of the Uganda kob, *Adenota kob thomasi* (Neumann, 1896) (Fig. 1), it became evident that the total population of about 15 000 animals was subdivided into thirteen to fifteen units, each attached to one of the arenas or territorial breeding grounds (TGs) existing in the area (Buechner 1961, 1963; Leuthold, in press). In over 90 % of the observations tagged animals were found within 0–4 km of the TG near which they were originally captured. As there were no geographical or ecological barriers between the different TGs, the attachment to a restricted area was thought to be based on tradition within the population units; its possible ecological implications have been discussed by Buechner (1963, in press). To test the strength of the traditional attachment of individual males to a TG and its vicinity, several kob were transported to an area presumed to be foreign to them; the areas of capture and release were visited frequently in an effort to keep track of the animals movements.

*Fig. 1.* Adult male Uganda kob. Height at shoulder ca. 100 cm, Weight 85—95 kg

## Methods

Eight adult males, all territorial on a TG, were captured with succcinycholine chloride as an immobilizing drug, administered by projectile syringes propelled from a modified shotgun (Buechner, in press). After immobilization the kob were tranquilized with "Largactil" (chloropromazine), blindfolded, and loaded into the back of the Landrover, with their legs tied. They were then driven to the location of release. They were marked conspicuously with colored plastic neckbands, ca. 10 cm wide, in addition to the ear tags used for marking other individuals.

The experiments were carried out in the Toro Game Reserve in Western Uganda, south of Lake Albert (see Fig. 2).

## Results

The different experiments and their results are summarized in Table 1 (see also Fig. 2).

All except one of the kob involved were seen at least once after the translocation. The male of experiment No. 6 was found killed by lions the day after release on TG 14. In all cases it is possible that a male returned to his original area earlier than stated here, escaping observation at first.

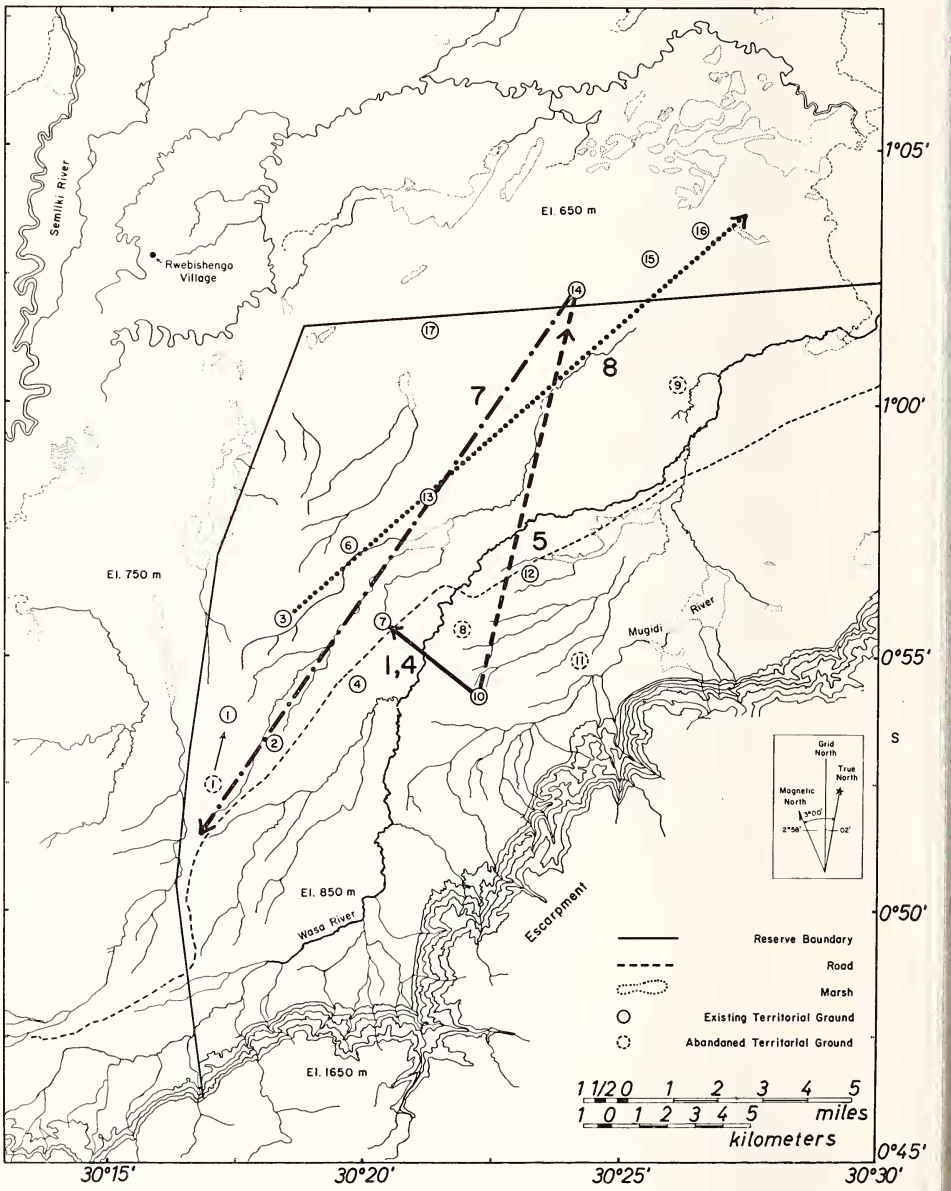


*Fig. 2.* Map of the Toro Game Reserve showing locations and distances involved in experiments Nos. 1, 4, 5, 7, 8

**Translocation experiments**

For details see text

| Experiment No. | Date | Original TG | New TG | Distance (km) | Direction | Date back at original TG | No. days for return |
|---|---|---|---|---|---|---|---|
| 1[1] | 11 Oct 62 | 10 | 7 | 5 | NW | (4 Jul 63)[2] | (>110) |
| 2 | 6 Oct 63 | 14 | 3 | 16 | NE | 14 Oct 63 | 8 |
| 3 | 6 Oct 63 | 3 | 14 | 16 | SW | 13 Oct 63 | 7 |
| 4[1] | 9 Oct 63 | 10 | 7 | 5 | NW | 4 Nov 63 | 26 |
| 5[1] | 15 Oct 63 | 10 | 14 | 15 | NNE | 21 Oct 63 | 6 |
| 6 | 26 Nov 63 | 3 | 14 | 16 | NE | —[2] | — |
| 7 | 27 Nov 63 | 14 | 1 | 23 | SSW | — | — |
| 8 | 3 Dec 63 | 3 | 16 | 22 | NE | 8 Dec 63 | 5 |

[1] These experiments involved transport across the Wasa River. — [2] Killed by lions.

The first male, transported in October 1962, joined the male herd of TG 7 with which he was subsequently seen 26 times during 3 1/2 months. After that he was never seen again. On 4 July 1963 his skull, recognizable by painted horns, was found on TG 10, on or near the territory which he had occupied at the time of capture. This indicated that he had: (1) returned to the original TG, (2) taken up a territory (which he had never done on TG 7), and (3) repossessed very probably the same territory he had held prior to the translocation.

The male of experiment No. 4 only stayed 3—4 weeks with the male herd of TG 7, before crossing the Wasa River and joining the bachelor herd of TG 10. The river is not likely to be a serious obstacle to the kob which have been reported to be good swimmers (Quotation in Bourlière and Verschuren 1960). However, in no case during the present study were kob known to have crossed the river entirely voluntarily.

Male No. 5 appeared on 18 October near our camp on the western bank of the Wasa River after traveling about 10 km in the direction of TG 10. On 21 October a hunter saw him with the male herd of TG 10 with which he was later found two more times until 23 February 1964. Male No. 7 was seen on 2 December 1963 ca. 1.5 km NE of TG 3 after moving 6.5 km from his point of release in the direction of TG 14. He was not observed with certainty after that, but a tagged male that was seen on 21 January and 26 February 1964 with the bachelor herd of TG 3 and could not be identified positively may have been this individual. If so, he would not have returned to his original TG during the three-month period between 27 November 1963 and 26 February 1964. — Male No. 8 was observed 18 times during 3 months after his return to TG 3 where he joined the male herd at first and later occupied a territory on TG 3 for 2 and 3 days on two separate occasions.

## Discussion

In six of seven successful experiments the male involved returned to his original home TG. In no case was a translocated male observed holding a territory on a TG presumed to be foreign to him, whereas joining the bachelor herd occurred at least temporarily. The results of these experiments thus confirm the high degree of attachment of individual males to a given TG, which had been indicated by other observations.

No translocations of females were carried out, but on the basis of observations on 75 tagged females (Buechner, in press) it appears probable that similar results would

have been obtained. The attachment to a given area is most likely to develop in young animals during their first few months of life when they still accompany their mothers. It seems reasonable, therefore, to assume that the females with young, through their own restriction to a given area, provide the traditional basis for the subdivision of the kob population into units each associated with one TG.

Besides their importance for the study of the social organization of the kob, the results of the translocation experiments are of interest with regard to problems of orientation and homing ability. The observations on males No. 5 and 7 suggest that they used a fairly straight line for their return trip, which would require a reliable mechanism of orientation. However, the number of observations is too small to permit a final answer to this question.

A variety of birds have been tested for their homing ability (for reviews see Schüz 1952, Matthews 1955), while much less research has been done with mammals. Homing of rodents (references in Bovet 1965) and bats (e. g., Smith and Hale 1953, Mueller and Emlen 1957) has been studied most extensively. Egoscue (1956) reports a captive kit fox *(Vulpes macrotis)* returning to his original home site over 20 miles (32 km). During transplantation and restocking operations with wapiti *(Cervus canadensis),* carried out by Game Departments in the United States, movements of transplanted animals over 80—110 km (in straight line) to original home areas have been reported (Anderson 1958). The experiments with the Uganda kob involved only distances of less than 25 km. A few cases of homing have been observed in European wild ungulates, e. g. the ibex *(Capra ibex;* Nievergelt 1966), and the roe-deer *(Capreolus capreolus;* Kurt, pers. comm.).

One important requirement for successful homing is the absence of effective geographic or ecological barriers in the experimental area. The Toro Game Reserve fulfills this requirement.

Explanations of the mechanisms of orientation involved in homing have rarely gone beyond speculation. Some workers suggest an innate ability for orientation largely independent of landmarks and other visual clues, a so-called "homing instinct". But Grzimek (1943) reports that five mares, blindfolded during translocation, were unable to find their way back from locations 5—15 km distant from the point of origin, suggesting that visual clues play an essential role in their orientation. The kob in the experiments described above did not have the opportunity of observing landmarks during their translocations; yet they returned to their home areas.

Other workers tried to explain the homing performances of some animals, particularly rodents, by assuming that the animals were familiar with an area considerably larger than their usual home range. While this might be true for certain rodents, it is unlikely to apply to the Uganda kob, in view of all the evidence pointing to a high degree of attachment to a restricted area. However, the possibility cannot be ruled out entirely as movements over areas larger than usual occurred during a period of drought in early 1964 (Leuthold, in press). Even if only exceptional, such movements could familiarize some animals with areas outside their usual home range.

One component of mammalian environments ordinarily remains out of reach of human research methods: olfactory stimuli. While orientation of the kob used in the translocation experiments may have been based partly on conspicuous landmarks such as escarpments or the high Ruwenzori Mountains, olfactory clues may have been more important. Scents characteristic of local combinations of soil type, vegetation, and animal populations, or moisture contents of the air at different distances from Lake Albert, may provide the kob with information on their location. But the actual mechanisms of orientation remain unknown.

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## Summary

Translocation experiments, involving distances of 5—23 km, were carried out with eight adult males of the Uganda kob *(Adenota kob thomasi)*. Five of them returned to their original home areas within periods ranging from 5 to 26 days, and one within 4 months. This indicates a strong attachment of individual males to a particular territorial breeding ground (arena or lek) and its vicinity, confirming the opinion expressed earlier that the kob population studied is subdivided into social units each associated with one arena.

Reports of homing in other mammals and the possible mechanisms of orientation are discussed, but not definite conclusions can be drawn.

## Zusammenfassung

Zur Untersuchung des Heimfindevermögens der Uganda-Kob-Antilope *(Adenota kob thomasi)* wurden acht adulte Böcke über Strecken von 5—23 km verfrachtet. Fünf von ihnen kehrten innerhalb von 5—26 Tagen, ein weiterer innerhalb von 4 Monaten, in ihre Herkunftsgebiete zurück. Dies bedeutet, daß die Böcke stark an ein bestimmtes, relativ kleines Gebiet gebunden sind. Diese Befunde bestätigen frühere Beobachtungen, nach denen die untersuchte Kob-Population in Untereinheiten aufgeteilt ist, die je mit einer der für dieses Gebiet charakteristischen Arenen (Paarungsplätze) assoziiert sind.

An Hand der Versuchsergebnisse und von Literaturbeispielen über Verfrachtungsversuche mit anderen Säugetieren werden die am Heimfindevermögen beteiligten Orientierungsmechanismen diskutiert, ohne daß jedoch eindeutige Schlüsse gezogen werden können.

## References

Anderson, C. C. (1958): The elk of Jackson Hole. Wyoming Game and Fish Commission, Cheyenne.

Bourlière, F., and Verschuren, J. (1960): Introduction à l'écologie des ongulés du Parc National Albert. Institut des Parcs Nationaux du Congo Belge, Bruxelles.

Bovet, J. (1965): Ein Versuch, wilde Mäuse unter Ausschluß optischer, akustischer und osmischer Merkmale auf Himmelsrichtungen zu dressieren. Z. Tierpsychol. 22, 835—859.

Buechner, H. K. (1961): Territorial behavior in Uganda kob. Science 133, 698—699.

Buechner, H. K. (1963): Territoriality as a behavioral adaptation to environment in Uganda kob. Proc. XVI Intern. Congr. Zoology 3, 59—63.

Buechner, H. K. (in press): Territoriality in an African antelope. A population study of behavior, reproduction and ecology of the Uganda kob.

Egoscue, H. J. (1956): Preliminary studies of the kit fox in Utah. J. Mammal. 37, 351—357.

Grzimek, B. (1943): Weitere Vergleichsversuche mit Wolf und Hund. Z. Tierpsychol. 5, 59—73.

Leuthold, W. (in press): Variations in territorial behavior of Uganda kob. Behaviour.

Matthews, G. V. T. (1955): Bird navigation. Cambridge University Press.

Mueller, H. C., and Emlen Jr., J. T. (1957): Homing in bats. Science 126, 307—308.

Nievergelt, B. (1966): Der Alpensteinbock in seinem Lebensraum. "Animalia depicta". Bd. I, Parey, Hamburg, 1966.

Schüz, E. (1952): Vom Vogelzug. Grundriß der Vogelzugkunde. Paul Schöps, Frankfurt a. Main.

Smith, E., and Hale, K. (1953): A homing record in the bat *Myotis l. lucifugus*. J. Mammal. 34, 122.

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